REMOTE SPECTRAL IMAGING OF GEOLOGIC FORMATIONS AND ZOETIC RESIDUES WITH ACTIVE EXCITATION DIODE ARRAYS. Robert A. Lodder[1*] and Gilbert V. Levin[2] . A123 Advanced Science and Technology Center, University of Kentucky, Lexington, KY 40506-0286. 2. Spherix Inc., 12051 Indian Creek Court, Beltsville, MD 20705

The 2009 Mars Science Laboratory Mission will use a rover to seek zoetic evidence ranging from fossils of extinct organisms to current habitats that could support life. However, Martian conditions impose severe limits on the number of sites that may be visited. The authors have proposed a remote-sensing experiment, SEARCH (Scan for Extinct Astrobiological Residues and Current Habitats) to be placed on the rover to find promising sites to visit for its detailed analyses, while SEARCH obtains it own significant scientific data (see Fig. 1). Small and low-powered, SEARCH senses evidence of extinct life, water and other targets of interest at distances of 1-10 m or greater. This is accomplished by a system of spectral imaging originally designed to search for remnants of biofilms in pharmaceutical cleaning validation. An array of UV/visible/ near-IR laser light frequencies aimed at a target reflects unique profile signatures for matching against a data bank of potential target specimens (see Fig. 2). Evidence sought would include residual forms of life, such as fossils (including extinct biofilms), water, amino acids, carbohydrates and other organic matter. SEARCH could be operated at night when conditions are ideal for spectral imaging.

While SEARCH would be developed to meet the dual Mars 2009 objectives of looking for evidence of extinct life and current habitats, the method can be enhanced to look for extant life in future missions. Phototrophic endolithic biofilms, such as cyanobacteria, live on rocks where water is available only intermittently. These cells produce mycosporine-like amino acids (MAAs) along with other compounds to serve as UV screens. Detection of these molecules can serve to identify biofilms. Initial work on this enhancement of SEARCH has begun. Figure 3 shows the detection of a living biofilm, and tracks its growth over time.

Fig. 1. Proof of concept robotic model of SEARCH instrument

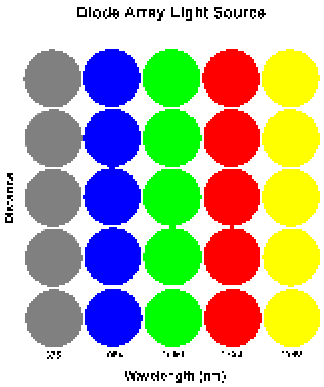

Fig. 2. SEARCH diode array light source

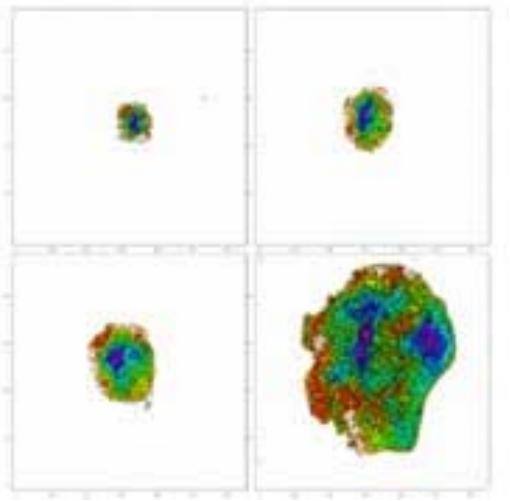

Fig. 3. BEST Contour plots of *Gloeocapsa* growing on 15 cm x 15 cm limestone wafer as seen at 9, 19, 37 and 56 days.